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◆FROM McCracken, S.H. ◆TO Erickson, L. ◆DATE 6/17/94
◆SUBJECT CODE/WORK PACKAGE NUMBER 05050
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42208

18 1 7 1994

Mr. Larry Erickson
Missouri Department of Natural Resources
Post Office Box 176
Jefferson City, Missouri 65102

Dear Mr. Erickson:

PRELIMINARY SAMPLING FOR SURFACE SOIL AT THE KATY TRAIL AREA

We have completed preliminary sampling for surface soil at the Katy Trail area, that included Vicinity Property (VP9) which is an area of study under the Quarry Residuals Operable Unit (QROU). Enclosed is a summary of the analytical results obtained from this sampling effort and results of preliminary risk calculations based on these data. These results indicate minimal and/or near background concentrations of parameters tested for and associated risk for a recreational user at this area to be well within the acceptable risk range as defined by the EPA. These results are also consistent with earlier observations and evaluations regarding surface soils at this area. However, a more definitive conclusion will be available after additional sampling (i.e., complete sampling coverage of area and parameters of concern) per discussions and planning in the work plan and sampling plan have been carried out and risk calculations completed as part of the RI/FS process undertaken for the QROU. The work plan has also provided for a removal action to be undertaken at the VP9 area in the case that this is warranted.

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Please call Karen Reed at (314)441-8978 if you have any questions.

Sincerely,

Stephen H. McCracken
Project Manager
Weldon Spring Site
Remedial Action Project

Enclosure:
As stated

cc w/enclosure:
Dan Wall, EPA
Martha Kopper/Geri Kountzman, MDNR
Mary Picel, ANL
Doug Steffen, PMC
Steve Warren, PMC
Bill Goldkamp, PMC
Ken Meyer, PMC
Tom Pauling, EW-94

EW-94:KReed:x7008:emh:6/17/94 (m:VicinPro.VP9)

CONCURRENCE
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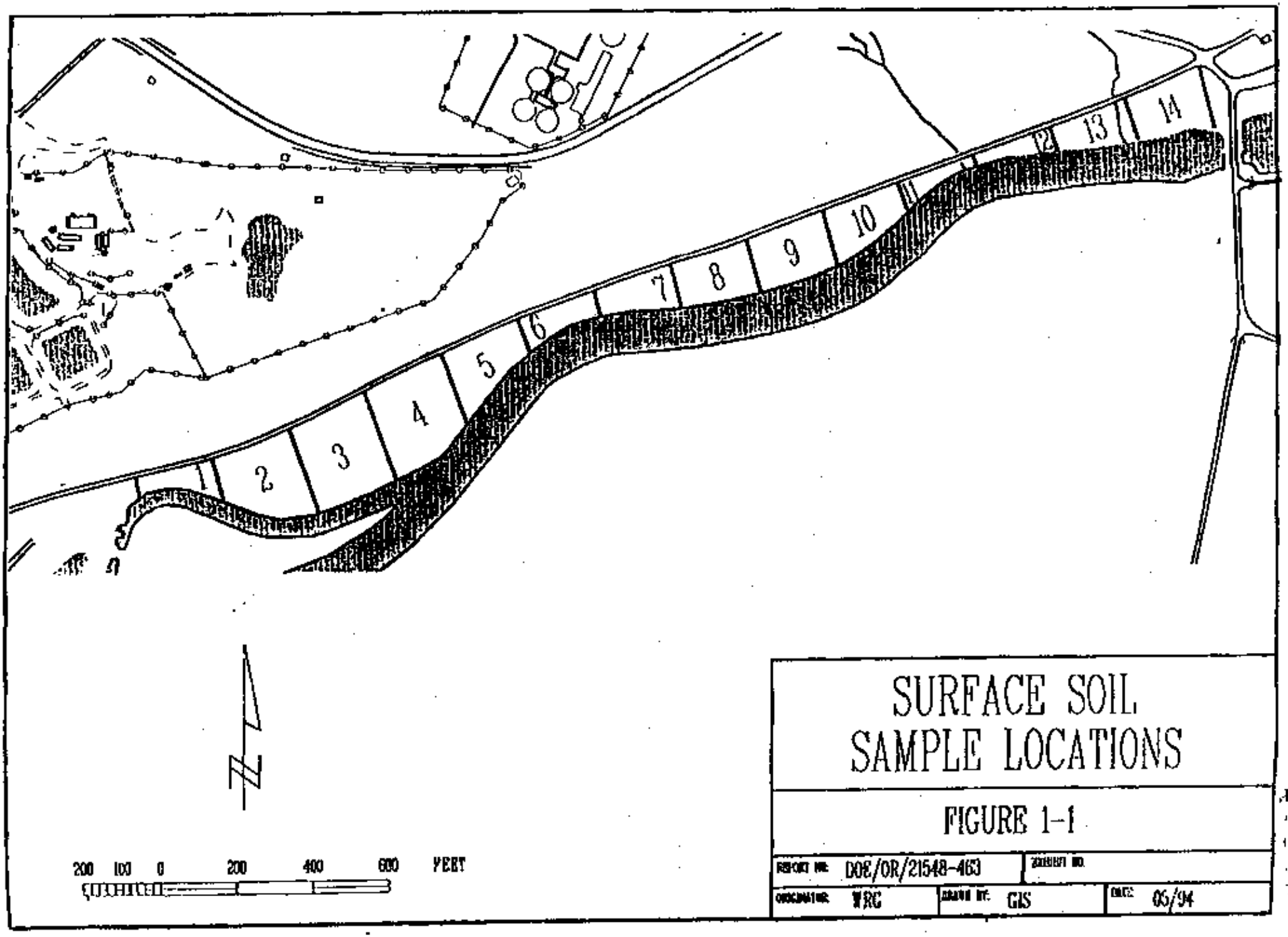
Enclosure

Preliminary Evaluation of Surface Soil at the Katy Trail/Vicinity Property 9 Area

Nine random surface (i.e., from the top 6 inches) samples were taken and composited from each of the 14 grid areas shown in Figure 1-1. Triplicate samples were analyzed for grid area 5 which encompasses the majority of Vicinity Property 9 (VP9). Grid areas 3 and 4 also include portions of VP9. Each grid area was 200 feet across and extended from the Katy Trail to the Femme Osage Slough. Analytical results are presented in Tables 1 through 3. These samples were collected as part of the sampling regime planned for the Quarry Residuals Operable Unit (QROU). The sampling regime as well as the rationale and procedures followed for the above sampling effort are discussed in the **Quarry Residuals Sampling Plan**, Rev. 1, dated January 1994.

Risk calculations were performed for a recreational visitor. In the **Work Plan for the Remedial Investigation/Feasibility Study-Environmental Assessment for the Quarry Residuals Operable Unit at the Weldon Spring Site**, dated January 1994, this receptor was identified as the most likely receptor to the VP9 area under current land use and under hypothetical future conditions. For this receptor, exposure to surface soil would be due primarily to direct ingestion of and dermal contact with soil and to inhalation of radon and airborne particulates derived from soil. For radiological contaminants, external gamma irradiation would also be an exposure pathway. The dermal pathway is excluded because for most compounds the necessary parameters for calculating the risks associated with this pathway are not available. Results of risk calculations are presented in Tables 4 through 6.

Results from the preliminary calculations indicate that human health risk is not a concern for a recreational receptor at the Katy Trail/VP9 area on the basis of levels of chemical and radiological constituents analyzed for in the surface soil samples obtained. Very conservative assumptions were incorporated into the preliminary risk calculations presented in this enclosure. For example, all results including values at the detection limits were included in the averaging; all parameters analyzed for were included in the calculations even though some of them were not detected at all and/or may not be contaminants of concern. Finally, these risk calculations were based on the average concentrations of data collected from the 14 grid areas which encompass more than the VP9 area (i.e., it was assumed that the recreational user would not preferentially visit one grid area over another). Nevertheless, if the recreational user preferentially visits the grid areas that encompass VP9 (i.e., grid area 5 and portions of grid areas 3 and 4), the risk would not be any greater because data indicate that uranium is the principal contaminant of concern in the VP9 area. As is evident in Table 4, the contribution from uranium represents only about 5% of the total risk. A more definitive conclusion will be available as additional sampling is completed and results are evaluated and incorporated into the final assessment performed under the RI/FS for the Quarry Residuals Operable Unit.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SURFACE SOIL
SAMPLE LOCATIONS
FIGURE 1-1
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Table 1 - Surface Soil Nitroaromatic Results:[a]

Location	Sample ID	1,3,5-TNB	1,3-DNB	2,4,6-TNT	2,4-DNT	2,6-DNT	NB
1	SO-194001	2.5	0.63	2.5	0.63	0.63	0.63
2	SO-194002	2.4	0.6	2.4	0.6	0.6	0.6
3	SO-194003	2.4	0.59	2.4	0.59	0.59	0.59
4	SO-194004	2.5	0.63	2.5	0.63	0.63	0.63
5	SO-194005	2.4	0.6	2.4	0.6	0.6	0.6
5	SO-194005-DU	2.4	0.6	2.4	0.6	0.6	0.6
5	SO-194015	2.5	0.63	2.5	0.63	0.63	0.63
6	SO-194006	2.2	0.56	2.2	0.56	0.56	0.56
7	SO-194007	2.5	0.62	2.5	0.62	0.62	0.62
8	SO-194008	2.3	0.57	2.3	0.57	0.57	0.57
9	SO-194009	2.3	0.59	2.3	0.59	0.59	0.59
10	SO-194010	2.2	0.55	2.2	0.55	0.55	0.55
11	SO-194011	2.4	0.6	2.4	0.6	0.6	0.6
12	SO-194012	2.4	0.59	2.4	0.59	0.59	0.59
13	SO-194013	2.2	0.56	2.2	0.56	0.56	0.56
14	SO-194014	2.4	0.61	2.4	0.61	0.61	0.61
	Mean	2.38	0.60	2.38	0.60	0.60	0.60
	Standard Deviation	0.11	0.026	0.11	0.026	0.026	0.026

[a] All samples were reported as non-detects. Values presented in this table represent the sample detection limits and were reported in mg/kg.

Table 2 - Surface Soil Metals Results: [a]

Location	Sample ID	Sulfate	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
1	SO-194001	340	5	192	(1.1)	12.7	16.7	(0.07)	(0.59)	(1.4)
2	SO-194002	496	4.9	170	(1.2)	11	15.7	(0.08)	(0.6)	(1.5)
3	SO-194003	1050	5.4	189	(1.2)	12.3	15.2	(0.08)	(0.63)	(1.5)
4	SO-194004	852	7.1	203	(1.3)	13.1	14.1	(0.08)	(0.63)	(1.6)
5	SO-194005	898	7.2	228	(1.3)	14.3	19.8	(0.08)	(0.67)	(1.7)
5	SO-194005-DU	870	6.7	225	(1.3)	14.5	14.5	(0.08)	0.77	(1.7)
5	SO-194015	872	5.9	217	(1.2)	13.5	15.6	(0.06)	(0.64)	(1.6)
6	SO-194006	596	7.4	209	(1.3)	13.1	29.3	(0.07)	(0.66)	(1.6)
7	SO-194007	619	5.7	195	(1.3)	13	17.5	(0.08)	(0.63)	(1.6)
8	SO-194008	427	6.3	193	(1.2)	12.9	18.9	(0.08)	(0.63)	(1.6)
9	SO-194009	356	6	192	(1.2)	13.3	17.1	(0.08)	(0.62)	(1.5)
10	SO-194010	550	6.8	186	(1.2)	11.7	15.4	(0.08)	0.64	(1.5)
11	SO-194011	564	6.1	208	(1.2)	13.6	17.9	(0.06)	(0.59)	(1.5)
12	SO-194012	400	6.6	196	(1.1)	13.4	16.2	(0.07)	(0.58)	(1.4)
13	SO-194013	421	6.2	182	(1.2)	11.9	16.8	(0.06)	(0.57)	(1.4)
14	SO-194014	448	8.3	246	(1.3)	15.2	21.6	(0.08)	(0.68)	(1.7)
	Mean	610	6.4	202	1.2	13.1	17.6	0.07	0.63	1.6
	Standard Deviation	226	0.9	19	0.068	1.1	3.7	0.0081	0.048	0.10

[a] Values in parenthesis represent sample detection limits because these samples were reported as non-detects. Results were reported in mg/kg.

Table 3 - Surface Soil Radiological Results: [a]

Location	Sample ID	Gross Alpha	Gross Beta	Radium-226	Radium-228	Thorium-228	Thorium-230	Thorium-232	Uranium-234	Uranium-238
1	SO-194001	16	25	1.9	2.1	1.3	2.7	1.3	0.95	0.95
2	SO-194002	26	30	1.1	2.2	1.4	1.3	1.2	1.1	1.1
3	SO-194003	30	32	1.2	1.5	1.2	1.4	1.6	5.5	5.5
4	SO-194004	23	33	2.4	1.4	1.6	1.6	1.1	5.5	5.5
5	SO-194005	54	51	1.3	2.2	1.1	1.7	1	14.5	14.5
5	SO-194005-DU	56	47	1.2	2.1	1.3	1.9	1.7	15.5	15.5
5	SO-194015	60	58	0.7	1.4	1.2	1.5	0.4	23.5	23.5
6	SO-194006	25	32	1.8	1.8	1	2	1.2	1.2	1.2
7	SO-194007	15	30	1.4	1.5	1.4	1.7	1.3	1.1	1.1
8	SO-194008	19	30	1.7	2.7	1.6	1.4	1.7	0.9	0.9
9	SO-194009	23	31	0.5	2.1	1.2	1.8	1.6	0.9	0.9
10	SO-194010	19	26	1.5	1.5	2	2.2	1.1	0.8	0.8
11	SO-194011	26	29	1.3	1.8	1.8	1.3	1.1	1.1	1.1
12	SO-194012	18	26	1.9	1.3	1.1	1.8	0.7	1	1
13	SO-194013	8.9	32	2.1	2.3	1.5	1.5	1.4	0.9	0.9
14	SO-194014	19	31	1.6	1.7	1.6	1.6	1	0.85	0.85
	Mean	27	34	1.5	1.85	1.39	1.71	1.21	4.71	4.71
	Standard Deviation	15	9.5	0.50	0.40	0.27	0.36	0.35	6.9	6.9

[a] Results were reported in pCi/g.

Table 4 - Estimated Radiological Risk from Exposure to Surface Soil for a Recreational User at the Katy Trail/VP9 Area

Radionuclides	Detection Frequency	UL95 Soil Concentration (pCi/g) [Rsi]	Exposure Point Concentration (pCi/g)	Risk [TR]
Ra-226	16/16	1.7	0.52	3.8E-06
Ra-228	16/16	2.0	0.80	1.8E-06
Th-230	16/16	1.9	0.67	1.6E-08
Th-232	16/16	1.4	0.16	2.0E-08
U-234	16/16	7.7	6.5	7.5E-08
U-238	16/16	7.7	6.5	2.0E-07
			Total Risk:	5.9E-06

a Preliminary calculations are based on limited surface soil sampling.

b A background concentration of 1.2 pCi/g (value obtained from the Baseline Assessment of the Chemical Plant Area of the Weldon Spring Site) for radium, thorium, and uranium was subtracted from the UL95 soil concentration and used as exposure point concentrations in the calculations.

c Calculated for each radionuclide accounting for all pathways of concern using the following equation.

$$TR = Rsi * (A + B + C + D)$$

where:

A = 6e-7/mrem * EF * ED * IRs * CF1 * DCFing;

B = 6e-7/mrem * ET * EF * ED * IRa * CF2 * (1/PEF) * DCFinh;

C = 6e-7/mrem * ET * EF * ED * DCFy; and

D = 2.5e-6 * ET * EF * ED * IRa * 3.5e-4/WLM

(term D is only included for radium-226).

and:

TR = excess individual lifetime cancer risk (unitless);

Rsi = soil concentration of radionuclide i (pCi/g);

IRa = inhalation rate (2.1 m3/h);

IRs = soil ingestion rate (120 mg/event);

CF1 = conversion factor (.001 g/mg);

CF2 = conversion factor (1000 g/kg);

ED = exposure duration (30 yr);

EF = exposure frequency (20 events/yr);

ET = exposure time (4 h/event);

PEF = particulate emission factor (4.63e9 m3/kg);

DCFy = external gamma dose conversion factor for radionuclide i [(mrem/h)/(pCi/g)], see Table 4A below;

DCFing = ingestion dose conversion factor for radionuclide i (mrem/pCi);

DCFinh = inhalation dose conversion factor for radionuclide i (mrem/pCi);

WLM = working level month.

d The risk from Ra-226 includes the contribution from Pb-210 and from inhalation of radon-222 generated from radium-226 in soil; the risk from radium-228 includes the contribution from thorium-228.

e U-234 and U-238 concentrations were assumed to be at equilibrium and were obtained by assuming each to be half of the total uranium concentration.

f Total estimated risk to a recreational visitor at the Katy Trail/VP9 area from surface soil results.

Table 4A - Dose Conversion Factors

Radionuclides	DCFing * (mrem/pCi)	DCFinh * (mrem/pCi)	DCFy * (mrem/pCi)	A (g/pCi)	B (g/pCi)	C (g/pCi)	D (g/pCi)
Ra-226	7.8E-05	2.9E-02	1.8E-03	3.4E-07	1.9E-11	2.59E-06	4.4E-06
Ra-228	1.95E-03	3.1E-01	1.5E-03	8.4E-08	2.0E-10	2.16E-06	-
Th-230	5.3E-04	3.2E-01	2.1E-07	2.3E-08	2.1E-10	3.02E-10	-
Th-232	2.8E-03	1.6E+00	1.2E-07	1.2E-07	1.0E-09	1.73E-10	-
U-234	2.6E-04	1.3E-01	1.4E-07	1.1E-08	8.5E-11	2.02E-10	-
U-238	2.5E-04	1.2E-01	1.4E-05	1.1E-08	7.8E-11	2.02E-08	-

* obtained from Table 4.1 of the Baseline Assessment for the Chemical Plant Area of the Weldon Spring Site.

Table 5 - Estimated Chemical Carcinogenic Risks from Exposure to Surface Soil for a Recreational User at the Katy Trail/VP9 Area [a]

Metals	Detection Frequency	UL95 Soil Concentration (mg/kg) [Csi]	Oral Slope Factor (mg/kg/d)-1 [SFoi]	Inhalation Slope Factor (mg/kg/d)-1 [SFii]	Risk [b] [TR]
Arsenic	16/16	6.8	1.8E+00	1.5E+01	4.1E-06
Cadmium	0/16	1.2		6.3E+00	3.1E-07
Chromium VI [c]	16/16	1.4		4.2E+01	2.4E-06
Nitroaromatic Compounds					
2,4-DNT	0/16	0.61	0.68		2.5E-13
2,6-DNT	0/16	0.61	0.68		2.5E-13
2,4,6-TNT	0/16	2.4	0.03		4.4E-14
				Total Risk: [d]	6.8E-06

[a] Preliminary calculations are based on limited surface soil sampling.

[b] Calculated for each chemical constituent accounting for all pathways of concern using the following equation.

$$TR = Csi * EF * ED * [(SFoi * CF3 * IRs) + (SFii * IRa * ET * 1/PEF)]/(BW * AT * CF4)$$

where:

Csi = soil concentration of contaminant i (mg/kg);

BW = average body weight over the exposure period (70 kg);

AT = averaging time (70 yr);

CF3 = conversion factor (1e-6 kg/mg);

CF4 = conversion factor (365 d/yr);

SFoi = oral slope factor for contaminant i ([mg/kg-d]-1); and

SFii = inhalation slope factor for contaminant i ([mg/kg-d]-1)

(other terms previously defined in Table 4).

[c] Concentration for Chromium VI assumed to be 10% of total chromium.

[d] Total estimated risk to a recreational visitor at the Katy Trail/VP9 area from surface soil results.

Table 6 - Estimated Chemical Hazard Index from Exposure to Surface Soil for a Recreational User at the Katy Trail/VP9 Area [a]

Metals	Detection Frequency	UL95 Soil Concentration (mg/kg) [Csi]	Oral Rfd (mg/kg/d) [RfDoi]	Inhalation Rfd (mg/kg/d) [RfDii]	Hazard Quotient [b] [THI]
Arsenic	16/16	6.7	3.0E-04	NA [c]	2.1E-03
Barium	16/16	210	7.0E-02	NA	2.8E-04
Cadmium	0/16	1.3	5.0E-04	NA	2.4E-04
Chromium III [d]	16/16	13	1.0E+00	NA	1.2E-06
Chromium VI [d]	16/16	1.4	5.0E-03	NA	2.6E-05
Selenium	2/16	0.65	5.0E-03	NA	1.2E-05
Silver	0/16	1.6	5.0E-03	NA	3.0E-05
Uranium	16/16	23	3.0E-03	NA	7.1E-04
Nitroaromatic Compounds					
1,3,5-TNB	0/16	2.4	0.00005	NA	4.5E-03
2,4,6-TNT	0/16	2.4	0.0005	NA	4.5E-04
2,4-DNT	0/16	0.61	2.0E-03	NA	2.9E-05
2,6-DNT	0/16	0.61	2.0E-03	NA	2.9E-05
				Hazard Index: [e]	8.5E-03

[a] Calculations are preliminary based on limited surface soil sampling.

[b] Calculated for the ingestion pathway only - toxicity values for inhalation pathway were not available for the parameters considered. The following equation was used in the calculation.

$$THI = Csi * EF * ED * (1/RfDoi * CF3 * IRs) + (1/RfDii * IRa * ET * 1/PEF))/(BW * AT * CF4)$$

where:

THI = target hazard index (unitless);

AT = averaging time (30 yr);

RfDoi = oral reference dose for contaminant i (mg/kg-d); and

RfDii = inhalation reference dose for contaminant i (mg/kg-d);

(other terms previously defined in Tables 4 and 5).

[c] NA means not available; see also footnote b above.

[d] Concentrations for Chromium III and Chromium VI assumed to be 90% and 10% of total chromium, respectively.

[e] A hazard index equal to or less than 1 is considered acceptable.